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PREFACE.

THE Astronomer Royal, in laying his report on the general proceedings of the Himalaya Expedition before the Royal Astronomical Society in 1860, remarked that—"In a subject where much of the value of the observations will depend on the comparison of different persons' observations, it may not improbably be found advantageous to break up each account, and to collect from all the different accounts, first those facts which relate to one part of the phenomena, and which will aptly form one large chapter; secondly, those which relate to another part of the phenomena, and which will form a second chapter, and so on."

With the view of making a systematic comparison of observations such as he had suggested, the Astronomer Royal collected all the manuscript and printed accounts of the observations of the total eclipse of July 1860 which he could procure. But his continuous duties as Director of the Royal Observatory prevented him from carrying his idea into execution; and in 1871, after the return of the 1870 Eclipse Expedition, he proposed that I should assist him in carrying out his plan, and should embody the observations of the Eclipse of December 1870 with the unpublished observations he had collected of the Eclipse of July 1860.

With this object I commenced abstracting and arranging the observations of the eclipses of 1860 and 1870 under various headings, and gradually enlarged the plan of the work, so as to include observations made during other eclipses, as the advantages of bringing together all the

observations which I could collect with respect to doubtful or varying phenomena became apparent. No attempt has been made to collate observations of the Eclipse of July 1878, but up to that date references are given to all the more important physical observations I have been able to collect. It will probably be found that many observations have been overlooked: I shall therefore feel obliged to readers who will inform me of the omissions they may notice, and I would suggest that if possible a copy of any such unnoticed observations should be sent to be deposited in the Library of the Royal Astronomical Society.

My thanks are due to the Astronomer Royal for many valuable suggestions. I must especially refer to the important suggestion that all the drawings of the corona should be oriented with the sun's axis vertical upon the page; which has greatly facilitated the comparison of coronal drawings, and has brought out in a striking manner the general symmetry of the coronas which have been observed, with respect to the sun's axis.

To LORD LINDSAY I am indebted for the loan of measuring apparatus and the use of his laboratory and a lime light, whilst cataloguing the details visible upon the 1871 corona photographs, as well as for the loan of books and other assistance.

To Mr. WESLEY I am especially indebted for the conscientious care he has bestowed upon the preparation of the illustrations in the volume, and for his assistance in cataloguing the details visible in the 1871 corona photographs—a work which occupied us more than a year.

To MR. MARTH I am indebted for checking nearly all the orientations and the statements involving calculations made in the volume. I am also indebted for the loan of books, manuscripts, and photographs to Padre SECCHI, Prof. ARGELANDER, Dr. SCHELLEN, Prof. YOUNG, Prof. WINLOCK, and others.

A. C. RANYARD.

Nov., 1879.

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CHAPTER I.

OBSERVATIONS OF THE OCCULTATION OF SUN SPOTS BY THE LIMB OF THE MOON.

ATTENTION has been paid to the occultation of sun spots for the purpose of determining whether any alteration such as might be produced by the intervention of a lunar atmosphere could be perceived; but DAWES in 1836, ARAGO in 1842, DAWES more carefully in 1858, ROTTENBERG, SECCHI, DAWES, DEMBOWSKI and BURZETTI, in 1860, OFFICERS OF THE FRENCH NAVY in 1861, PRINCE and BRETT in 1870, have been unable to perceive any distortion. Under the head of negative evidence, see also observations of the sun's spectrum close to the moon's limb contained in the spectroscopic reports* of YOUNG, 1869, and STONE, 1874, where the slit was so placed that the image of the solar crescent fell upon one part of it, and the image of the dark moon upon the other; but no difference was detected in the Fraunhofer lines, at the place where they were seen to be sharply cut off by the limb of the moon.

LIAIS, in 1858, thought he saw the penumbra of one of the larger spots flattened out parallel to the moon's limb just before it was occulted, and he again observed a similar slight distortion on its reappearance. SCHOTT, in 1869, saw a black ligament form and re-form as the spots approached the advancing limb of the moon.

THE EMPEROR OF BRAZIL, in 1858, observed a yellowish tinge spread over the spots as the moon's limb approached them; and TALMAGE, in 1861, describes one of the spots as suddenly blazing forth with a mauve tint round it.

DAWES, in 1836, saw the black nucleus of one of the spots "considerably illuminated close to the moon's limb," but in 1858, after a

* Given in the chapter upon "The Band or Fringe along the Moon's Limb," p. 10.

“careful scrutiny,” he came to the conclusion that “in no instance was either a bright or a dark object affected by the vicinity or contact of the moon’s edge.” ROTTENBERG, in 1860, observed that the nucleus and penumbra of a large spot appeared to grow fainter as they were occulted; and SECCHI, in 1860, found the penumbra of a spot grow hazy at the moment of its occultation. The explanation of these latter observations may possibly be connected with the phenomenon described in the next chapter—the sense of contrast between the colour of the spots and the blackness of the moon’s disc not being perceived until they were in absolute contact.

Rev. W. R. Dawes.

ORMSKIRK,
15th May, 1836.

“Monthly Notices of the Royal Astronomical Society,” Vol. iv.,
p. 24.

On the moon’s edge passing over the largest of the solar spots visible on the day of the eclipse, a phenomenon was distinctly noticed, which was not observed during the occultation of any of the smaller ones. The black nucleus appeared considerably illuminated close to the moon’s limb.

No distortion of the edges of the spot was noticed by any of the observers.

M. Arago.

PERPIGNAN,
8th July, 1842.

“Annuaire pour 1846 du Bureau des Longitudes,” p. 351.

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Nous ne parvîmes pas, mes collaborateurs et moi, à saisir la moindre trace d’une atmosphère lunaire. M. Eugène Bouvard, à Digne, ne fut pas plus heureux. Aucune des facules qu’il vit s’enfoncer sous le disque obscur de la Lune ou reparaitre, ne sembla altérée ni dans sa forme ni dans son intensité.

Rev. W. R. Dawes.

HADDENHAM, NEAR THAME,
15th March, 1858.

"Monthly Notices," Vol. xviii., p. 188.

I employed an excellent $7\frac{1}{2}$ -inch object-glass recently received from Mr. Alvan Clark. The steadiness and distinctness of the image induced me to pay especial attention to the appearance of well-marked *pores*, and small bright spots, or *loculi*, on the sun's surface, as the moon approached and occulted them. Keeping my eye steadily upon them, I was able, in numerous instances, to note whether the edge of the moon produced any dimness or distortion or change of place as it touched and passed over them. The same close attention was bestowed upon the best-defined portions of the extremely delicate network connected with the magnificent mass of solar spots; which was just completely occulted by the moon when the clouds thickened, and the sun was seen no more till after the eclipse terminated.

The result of this careful scrutiny was, that in no instance was either a bright or a dark object affected by the vicinity or contact of the moon's edge previously to its occultation. No dark shade adhering to its edge was seen on the bright parts, nor was any bright line visible on the dark parts, as they successively disappeared. No distortion, or tremour, or projection, was perceived in any of the numerous objects thus examined during the fifty minutes of visibility.

Dr. Liais.

PARANAGUÁ,
7th Sept., 1858.

"Astr. Nachr.," Vol. xlix., p. 278.

A la station centrale de Paranaguá M. LIAIS a noté que le bord de la lune s'est trouvé en contact avec le bord de la pénombre du 3^{me} groupe de taches solaires, celui qui était le plus près du centre de l'astre, à 10 h. 13 m. 32 s., achevant aussi de recouvrir cette pénombre. Il a de plus remarqué qu'à mesure que le bord de la lune recouvrait la pénombre, cette dernière semblait près de l'instant du contact, éprouver une petite variation de forme, son bord paraissant s'aplatir parallèlement au bord de la lune. Une apparence semblable s'est produite dans la seconde partie de l'éclipse à la réapparition des taches. Cette observation a été faite avec un grossissement de 300 fois.

Apparent alteration in form of spots as they were eclipsed by the moon's limb.

M. Coilho.

PARANAGUÁ,
7th Sept., 1858.

"Astr. Nachr.," Vol. xlix., p. 278.

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M. COILHO a noté qu'au moment où le bord de la lune allait occulter les taches, ces dernières n'ont paru éprouver aucune variation d'intensité. comme cela aurait eu lieu s'il s'était produit l'interposition d'une atmosphère lunaire.

The Emperor of Brazil.

PALACE OF ST. CHRISTOPHER,
7th Sept., 1858.

"Astr. Nachr.," Vol. xlix., p. 278.

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Il a été également remarqué au Palais Impérial de St. Christophe, en regardant le soleil dans une lunette puissante avec une verre vert que, quand la lune a approché de la grande tache et de la suivante, on a cru voir se répandre sur elles une couleur jaunâtre. Cette couleur a semblé se disperser déjà sur le groupe des petites taches, quand déjà la lune couvrait la moitié de la grande tache.

Baron de Rottenberg.

VALENCIA,
18th July, 1860.

MS. Observations of the Himalaya Expedition.

When the large spot was occulted the penumbra got very faint when the nucleus was hid; and the nucleus seemed to get fainter when about one-half of it was covered. I observed no distortion whatever of the form of the spot.

Padre Secchi.

DESIERTO DE LAS PALMAS,
18th July, 1860.

"Relazione delle Osservazioni," etc.: P. Secchi, Rome, 1860.

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Le macchi del sole non mostiarono veruna distorsione all'istante della loro occultazione, e solo trovai un poco di indecisione nell' occultazione della penombra, il che si deve alla lor naturale sfumatura.

The Rev. W. R. Dawes.

HADDENHAM, BUCKS,
18th July, 1860.

"Monthly Notices," Vol. xxi., p. 26.

I employed my $8\frac{1}{2}$ -inch object-glass, with powers of from 145 to about 520. The most minute and delicate feathery portions of the penumbra of the large spot in the sun's north-western quadrant were thus brought out with admirable distinctness, and their occultation by the moon's sharply defined edge was thus carefully watched. Neither on these nor on the darker part (or *umbra*) of the spot was the slightest effect produced, either in form or shade, previous to their disappearance.

Baron Dembowski.

MILAN,

M. Burzetti.

18th July, 1860.

"Astr. Nachr.," Vol. liii., p. 343.

Or malgré la plus grande attention possibles, ni M. BURZETTI, ni moi, nous n'avons pu remarquer le moindre changement appréciable dans la forme des taches.

No change noticed.

Officers of the French Navy.

SAINT LOUIS, SENEGAL,
31st Dec., 1861.

"Monthly Notices," Vol. xxii., p. 168.

Aucune des taches en s'immergeant, ou en reparaissent, n'a subi la moindre altération de forme.

No alteration form.

Mr. C. G. Talmage.

NICE,
31st Dec., 1861.

"Monthly Notices," Vol. xxii., p. 52.

At the total immersion of one of the spots, it seemed suddenly to blaze forth, and quite a mauve tint was visible round it.

Mr. Charles A. Schott.

SPRINGFIELD, ILLINOIS,
7th Aug., 1869.

"United States Coast Survey Report" for 1869, Appendix viii., p. 36.

When the moon's limb had nearly touched the penumbra of the spot, a black band suddenly shot out from the umbra (of the same width), and for an instant was connected with the moon's limb; it then retreated and re-formed, making apparently a bridge across the penumbra; it was then gradually shortened and covered by the advancing moon. This connection was distinctly seen for several seconds, though each forming, retreating, and re-forming, was, perhaps, completed in half a second.

Mr. Prince.

UCKFIELD, SUSSEX,
22nd Dec., 1870.

"Monthly Notices," Vol. xxx., p. 67.

I particularly noticed that the penumbra of each [of the spots] was well defined to the instant of occultation.

Mr. John Brett.

AUGUSTA,
22nd Dec., 1870.

"Monthly Notices," Vol. xxxi., p. 164.

At Mr. Burton's suggestion I very carefully observed the eclipse of two large spots, with power 200 for distortion, but found no trace of any definition being then good.

CHAPTER II.

THE MOON SEEN TO BE DARKER THAN SUN SPOTS.

DURING the passage of the moon's limb over sun spots, a good opportunity is afforded of comparing the blackness or colour of the nucleus of the spots with that of the moon's disc. It should be remembered that during the partial phases of an eclipse the atmosphere between the observer and the sun is brilliantly illuminated, and, added to this, the moon is exposed to full or nearly full earthshine.* The moon nevertheless appears as a deep black compared with the darkest parts of the sun spots. MADLER, WEYER, HAASE, DEMBOWSKI and BURZETTI in 1860, and DANCER and PRINCE in 1870, describe the moon's disc as much blacker than the sun spots; while W. F. is alone in describing the moon and sun spots as "of so precisely the same tint" that they appeared "to be merged" in one another. LONGOMONTANUS's observation was made with one of the earliest telescopes,† and can hardly be compared with the above: to his eye the sun spots appeared darker than the moon.

The moon is described by

Weyer	as	deep black,
Haase	as	tief schwarz,
Dembowski	}	as noir le plus parfait qu'on puisse imaginer,
Burzetti		
Dancer	as	black,
Prince	as	intensely black.

* It will be seen from a future chapter that even during totality the illumination of the atmosphere over the moon's place is sufficient so completely to overpower the effects of earthshine upon the moon that the maria and other details are not distinguishable.

† Longomontanus's observation is described as being made "per tubum." As the eclipse took place only three years after the date usually assigned for the discovery of the telescope, it is probable that the optical means at his disposal were very inferior.

The spots are described by

Madler	as	grau,
Weyer	as	gray-black,
Haase	as	hell-braun,
Dembowski	}	as brun foncé.
Burzetti		

Longomontanus.

20th May, 1612.

"Historia Cœlestis," fol. 1666, Vol. II. Parlipomenos, p. 922.

Maculæ Solis tunc apparebant nigriores quam Luna.

Dr. J. H. von Madler.

VICTORIA,
18th July, 1860.

"Ueber Totale Sonnenfinsternisse." DR. VON MADLER.

Die Bedeckung des Sonnenflecks, konnte ziemlich scharf beobachtet werden; und der Unterschied der Intensität zwischen Mond und Fleck war ein überaus grosser. Der vorhin schwarz erscheinender Fleck konnte kaum noch als Grau bezeichnet werden.

Prof. G. D. E. Weyer.

VICTORIA,
18th July, 1860.

MS. Reports of the Himalaya Expedition.

The deep black colour of the moon (as it passed across the solar disc) was in remarkable contrast to the lighter gray-black colour of the solar spots, even in their darkest parts.

Herr C. Haase.

VALENCIA,
18th July, 1860.

"Astr. Nachr.," Vol. liv., p. 339.

Im Vergleich zu dem tief schwarz gefärbten Mondkörper erschien mir die Farbe der Kernflecken, die ich vorher ebenfalls für schwarz gehalten, nur noch hellbraun.

Baron Dembowski.
M. Burzetti.

MILAN,
18th July, 1860.

"Astr. Nachr.," Vol. liii., p. 343.

La seule chose que je remarquai, ce fut que les fonds des taches, qui éloignées du bord de la lune paraissaient, devenaient d'une couleur brun foncé, tandis que le disque de notre satellite était du noir le plus parfait qu'on puisse imaginer.

Spots on the brown moon perfect as far as one can imagine.

W. F.

EXETER,
22nd Dec., 1870.

"Nature," Vol. iii., p. 185.

A remarkable phase in the moon's passage across the sun was the perfect apparent contact of the limb of the moon with a sun spot. The noticeable thing was that the body of the moon itself and the sun spots were of so precisely the same tint that no trace of a division was perceptible,—one appearing to be merged in the other as long as the contact lasted.

Mr. J. B. Dancer.

ARDWICK, NEAR MANCHESTER,
22nd Dec., 1870.

"Monthly Notices," Vol. xxxi., p. 68.

The black surface of the moon, when projected on the sun's disc, appeared very uniform in colour, and darker than any of the spots.

Mr. Prince.

UCKFIELD, SUSSEX,
22nd Dec., 1870.

"Monthly Notices," Vol. xxxi., p. 67.

The moon appeared intensely black while passing over the sun's disc, and it was interesting to observe how much darker the limb was than either the umbra or the actual nucleus of any spot.

CHAPTER III.

BAND OR FRINGE ALONG MOON'S LIMB.

THIS chapter contains observations of fringes of colour and dark and bright bands which have been noticed by various observers along the part of the limb of the moon which is projected upon the sun's disc during the partial phases. It will be seen that the phenomena described cannot all be accounted for by supposing that the instruments used by the observers were not sufficiently corrected for colour; nor can they be explained as due merely to an effect of contrast between the light and dark discs of the sun and moon. In many instances the observers describe the fringes as growing in intensity, or springing into existence, at a certain time or period of the eclipse; but it does not appear with sufficient distinctness that they had given their attention to the same phenomenon before. None of the observers, except GILLISS in 1860, describe the fringes as disappearing or growing faint at a certain time.

The observations are not always described with sufficient distinctness to enable us to determine whether the fringes were seen upon the moon's disc or upon that of the sun; and when described as upon the sun, it is not always clear whether the observer means that the fringes were upon the sun's limb (that is, on the convex side of the crescent), or upon the part of the sun's disc adjacent to the moon's limb (the concave side of the crescent). If the coloured fringes were due to want of achromatism in the object-glass, we should expect to find the same outstanding fringe of colour on both the convex and concave sides of the crescent; but in no instance is this the case. If due to the eyepiece, we should expect, with a narrow crescent nearly filling the field, to find a red fringe on one side of the crescent and a blue fringe on the other side; but the fringe would be lost when brought to the centre of the field. First, as to those observers who describe bands or fringes without specially noting them as coloured.

Upon the sun's disc :—

- 1836. **Coulier.** Several shadowy circles preceding the lunar limb.
- 1858. **Paroissien.** Band surrounding moon's limb.
- Stuart.** Three faint bands or fringes evidently on the sun's disc from the description of the lunar mountain.
- 1860. **Venables.** Portion of sun around moon's edge brighter.
- Murray.** Light whitish ring, broader after totality.

Upon the moon's disc :—

- 1870. **Weston.** Disc of moon enlightened for some distance from its periphery.
- Brett.** Weak illumination encroaching upon moon.

Upon the discs of both sun and moon :—

- 1851. **Aidie.** Narrow sharp band round the part of moon's disc projected on sun ; within this a portion of body of moon illuminated.

On the other hand, LANE in 1854 says he made it his chief business to look for the fringe of light which observers had noticed along the moon's limb, but saw none when the eye was kept fixed, though with the eye in motion a coloured border was often very vivid. VENABLE in 1860 could see no fringe when looking through his telescope, though he saw one with the naked eye ; and HARKNESS and TUPMAN in 1870 could not make sure of the existence of such a fringe.

Observers who describe coloured fringes :—

- 1851. **Busch.** Orange-red fringe on moon ; violet light on sun's limb.
- Fearnley.** Orange fringe on moon, and a corresponding light-blue on the other side (*query* of crescent).
- 1857. **Clarke.** Blue edge outside ; red light along inner edge of sun's lower limb.
- 1860. **Gilliss.** Violet or reddish-blue fringe.
- Smith.** Before totality a narrow band of deep yellow ; after totality blue band made up of radiations perpendicular to limb on moon, and yellow band (*query* on sun).
- 1861. **Hardy.** On moon band of deep purple ; on sun brighter band, separated from the moon's edge by pale-green shadow.
- Talmage.** On moon streak of red light.
- 1867. **Weiss.** Yellow faint light on moon.
- 1869. **Hough.** Red band on sun.

Many of the observers mention a definite time at which they observed the fringes,—leaving it to be inferred that no fringe was visible before that time ; and BUSCH states definitely that the fringes became visible at a certain time, and that they were not visible before.

1851. Aidie. At 3h. 35m.
 Busch. About 3h. 37m., light on moon; 10 or 15 seconds later, fringe on sun.
 Before this the moon's limb had appeared black.
1858. Paroissien. When a considerable portion of the sun had reappeared, I observed. . . .
 Stuart. Ten minutes after the commencement of the eclipse.
1860. Gilliss Says that the fringe *disappeared* gradually, after the moon's limb had
 passed the sun's centre.
1861. Hardy. Soon after the eclipse began, and for some time afterwards.
 Talmage. At 3h. 45m.
1869. Hough. When the sun was about half eclipsed.
1870. Harkness. At 12h. 8m. I fancied I saw a very faint and narrow bright line.

Though the fringes are usually described as lying symmetrically along the whole length of the part of the moon's limb seen projected upon the sun, yet in some instances this is not the case.

1851. Busch. Colour on moon concentric with limb. Colour on sun crescent-shaped, and not reaching as far as the sun's cusps.
1857. Clark. Red light along the inner edge of the sun's lower limb.
1861. Talmage. Semicircular streak on moon, gradually diminishing to two abrupt points.
1867. Weiss. Faint yellow light, most distinct near protuberance.

M. Coulier.

(No place given),
 15th May, 1836.

"Comptes Rendus," Tome ii., p. 497.

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M. Coulier parle dans sa lettre de plusieurs cercles ombrés qui précédaient le corps de la Lune, et qu'il est disposé à attribuer à l'atmosphère lunaire.

Mr. John Aidie.

GÖTHA KELLARE HOTEL, GÖTTENBURG,
 28th July, 1851.

"Monthly Notices," Vol. xii., p. 63.

At 3h. 35m. Göttenburg M.T., the moon appeared to have a narrow sharp band, intensely black, round the whole portion of her disc seen projected on the sun; while within this black band, a portion of the body of the moon appeared illuminated, and of a greyish white colour.

Dr. Busch.

RIXHÖFT,
28th July, 1851.

“Astr. Nachr.,” Vol. xxxiii., p. 231.

Nachdem ich einige Notizen aufgeschrieben und darauf wieder in das Fernrohr sah, bemerkte ich, etwa um 3h. 37m., dass der noch kurz vorher schwarz erscheinende Mondrand mit einem Saume von orangerother Farbe umgeben war, und dass etwa 10 bis 15 Sekunden später, der bis dahin ebenfalls farblos gewesene Sonnenrand einen Anflug von Violett annahm. Dieses violette Licht wurde nach und nach am Sonnenrande immer dunkler und verbreitete sich, in den feinsten Abstufungen, bis zur Mitte der Sonnensichel, wo es dann in ganz schwaches Gelb überging. Der farbige schmale Ring um den sichtbaren Mondrand war mit der Mondscheibe concentrisch, dagegen erschien das violette Licht sichelförmig ohne sich bis zu den Hörnerspitzen der Sonnensichel auszudehnen.

Orange-red
fringe along
moon's limb
Violet light
sun's limb.
Broadest no
cusps (quer

Prof. Fearnley.

RIXHÖFT,
28th July, 1851.

“Astr. Nachr.,” Vol. xxxiii., p. 237.

Von den gefärbten Rändern der Sichel, die Director Busch mit besonderer Aufmerksamkeit beobachtet hat, kann ich nur soviel sagen, dass allerdings ein feiner, aber intensiver orangefarbiger Saum am Mondrande und ein entsprechender hellblauer auf der anderen Seite mir mehrmals bei der schon kleinen Sichel aufgefallen ist.

Orange frin
along the m
limb and co
sponding li
blue on oth
side.

Mr. J. Homer Lane.

WASHINGTON,
26th May, 1854.

“United States Coast Survey Report” for 1869, Appendix No. 8, p. 59.

I made it my chief business during the continuance of the eclipse to look for the fringe of light which has sometimes been reported as seen along the moon's limb projected on the sun's disc; I saw nothing of the kind except what was distinctly traced at the time to the eye itself. I experimented on this point all through the time of the eclipse. Whenever the eye was held for some little length of time without a wink, and in complete fixity upon the object, all distinctively border-light invariably disappeared, leaving nothing but purely the projection of the moon's form

upon the sun. But not the slightest movement or change in the eye could take place, with this point on the attention, without calling into instant being a coloured border, often very vivid.

The Rev. W. B. Clarke.

SYDNEY,
26th March, 1857.

"Monthly Notices," Vol. xviii., p. 41.

Mr. C. Martens, of St. Leonard's, very ingeniously threw an image of the eclipse through his inverting telescope upon a white screen, and saw a *blue* edge *outside* the indentations of the moon's disc, and a bright *red* light along the *inner* edge of the sun's lower limb.

Rev. Challis Paroissien.

HARDINGHAM, NORFOLK,
15th March, 1858.

"Monthly Notices," Vol. xviii., p. 249.

When a considerable portion of the sun had reappeared I observed distinctly a circular band, surrounding the portion of the moon's dark limb that was projected on the solar disc. . . . The space included between this circle and the dark edge was the slightest possible shade darker than the sun's disc.

Mr. C. Stuart.

IPSWICH,
15th March, 1858.

"Monthly Notices," Vol. xviii., p. 194.

[Ten minutes after the commencement of the eclipse.] The light from the sun was very distinctly seen within the edges, and slightly illuminating the dark body of the moon for a short distance, and had the appearance at its termination of three faint bands or fringes of light parallel with the edge of the moon. . . . It was in the light passing inwards along the convex surface of the moon that the before-mentioned lunar mountain was situated; it did not appear to me to be directly on the edge, but a little inside of it, yet still high enough for the top to be beyond the edge, and appear in dark relief upon the sun's disc.

Lieut. J. M. Gilliss.

STEILACON, WASHINGTON TERRITORY,
18th July, 1860.

"Coast Survey Reports," 1860; Appendix No. 22.

Instrument.—A comet-seeker, made by Merz and Mahler of Munich, $3\frac{9}{16}$ in. clear aperture and 34.6 in. focal length. The eyepiece magnified thirty-two times, and was fitted with a series of differently-tinted screen glasses.

(p. 13.) [During the partial phases after totality] I observed that closely around the following limb as it passed over the sun, and until it was beyond the centre of the latter, was a delicate violet or reddish-blue fringe, which made it difficult to detect the exact instant at which the solar spots emerged. The fringe disappeared gradually.

Prof. A. W. Smith.

AULEZAVIK ISLAND,
18th July, 1860.

"Coast Survey Reports," 1860; Appendix No. 21.

Instrument.—A telescope made by Plössl of Vienna, with an object-glass of about 3 in. aperture and 38 in. focal length.

(p. 26.) A bright but narrow band of deep yellow was seen soon after the moon's limb entered upon the sun's disc, and was visible, or was seen, till the moon approached the large dark spot on the sun. It may have continued longer visible, but my attention was not subsequently directed to it. This was not the effect of chromatic aberration, as the whole band was made to pass near the centre of the field, and was separated from the white light of the sun by a distinctly-seen dark line.

[After totality] a blue band of considerable breadth surrounded that portion of the moon which covered the sun. This band appeared to be made of radiations of blue light of different degrees of intensity in a direction perpendicular to the sun's surface. It was bounded by a well-defined line on the moon's surface. I was instantly reminded of the "mirage" so frequently witnessed on our voyage to this place, in which the horizon appeared to be skirted by a blue sea-wall. The resemblance to an unbroken sheet of water (varying in thickness or irregular in surface, so as to vary the shading) falling over a mill-dam also occurred to me. At the base, where it was in contact with the sun, was a very narrow band or line of yellow as noted before totality.

(p. 25.) I decided to use a low power which would bring the whole disc of the sun into the field at once. I found, however, while observing the eclipse, a perceptible want of achromatism on the borders of the field. The screen used gave a white image of the sun.

Prof. C. S. Venables.

AULEZAVIK ISLAND,
18th July, 1860.

"Coast Survey Reports," 1860; Appendix No. 21, p. 27.

Several times during the partial phases I thought the portion of the sun around the moon's edge brighter than the rest, but could not with my telescope distinguish it as a bright band around the moon's edge.

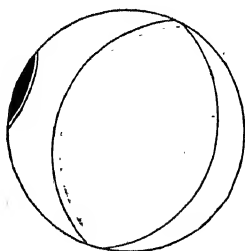
Mr. E. W. Murray.

LLOLIO,
18th July, 1860.

MS. Reports of the Himalaya Expedition.

Before the totality I could see plainly the light whitish ring—being in width, as far as I could judge, about $\frac{1}{10}$ th the diameter of the moon. It was from this ring that the corona sprang: it skirted the hinder part of the moon, though as yet no rays shot forth from it.

Also when the totality was over, and the moon had passed over perhaps



a quarter of the sun in its retreat, I observed what I supposed to be the same ring,—very much smaller than the ring during the totality; but nearly double the size of the ring which I observed on the advancing edge. I have marked them both in the figure. When a black surface passes over a shining one, there generally appears a lighter-coloured ring at the edge of the black surface: but why the difference in widths, with the advancing and retreating moon, when almost the same surface of sun was exposed?

Mr. R. W. H. Hardy.

SION HILL, BATH,
31st Dec., 1861.

"Monthly Notices," Vol. xxii., p. 90.

Soon after the eclipse began, and for some time afterwards, the overlapping surface of the moon was covered over with a soft grey tint, which terminated on the advancing edge in a narrow band of deep purple. Concurrently with this purple band there appeared, in advance of the moon's edge, but concentric with it, at a short distance, a bright gleam of light, brighter than the solar disc. This light was separated from the moon's edge by a narrow pale-green shadow, which softened into the former. . . .

My telescope is a 12-inch Newtonian reflector; the eyepiece I used on the occasion was an inverting one, and the power employed, sixty times,—which takes all the sun into the field. The projecting glass was a neutral tint, which does not materially affect the appearance of the colour of natural objects.

Mr. Talmage.

NICE,
31st Dec., 1861.

"Monthly Notices," Vol. xxii., p. 92.

At 3 h. 45 m., a remarkable phenomenon presented itself on the surface of the moon: there appeared a semicircular streak of red light close to the limb, gradually diminishing to two abrupt points.

Dr. Ed. Weiss.

RAGUSA,
6th March, 1867.

Vol. lv. of the Sitzb. d. k. Akad. d. Wissensch, ii. Abth., May, 1867.

(p. 17.) Endlich zeigte sich innerhalb des Mondrandes ein gelblicher, Schimmer der in der Gegend der Protuberanz,* am deutlichsten auftrat.

Yellow light inside the moon's limb—brightest near protuberance.

Prof. G. W. Hough.

MATTOON, ILLINOIS,
7th Aug., 1869.

"Journal of the Franklin Institute," Jan. 1870, p. 61.

When the sun was about half eclipsed, a red band of light was seen surrounding the limb of the moon over the solar disc.

* This was long before the period of greatest obscuration. The eclipse was annular.

Mr. Charles H. Weston.

LANSDOWN, NEAR BATH,
22nd Dec., 1870.

"Monthly Notices," Vol. xxxi., p. 70.

The disc of the moon overlapping the sun was *not uniformly dark, but enlightened for some distance from its periphery coextensively with the arc of contact.*

Mr. John Brett.

AUGUSTA,
22nd Dec., 1870.

"Monthly Notices," Vol. xxxi., p. 164.

There was a weak illumination encroaching upon the moon, of a greyish tint; but it faded away from the limb inwards imperceptibly.

Prof. Harkness.

SYRACUSE,
22nd Dec., 1870.

"Washington Observations," 1869, Appendix I., p. 79.

As the eclipse advanced, I looked very carefully for the bright line which was shown in such a marked manner along the edge of the moon's limb in the photographs taken by Dr. Curtis, at Des Moines, in August 1869; but, although I used both red and neutral tint shade-glasses, and the definition in the telescope was excellent, I could not see any trace of it till 12 h. 8 m., when I fancied I saw a very faint and narrow bright line; but I am far from being certain that such a line really existed. In fact, I am inclined to think it was only the effect of contrast between the bright sun and the dark moon.

Capt. Tupman.

SYRACUSE,
22nd Dec., 1870.

"Washington Observations," 1870, Appendix I., p. 118.

During the partial phase we looked for a line of brighter light on the sun parallel to the limb of the moon. I once or twice fancied something of the kind, but the immediate contrast would account for it. I think it was with a power of eighty or ninety, with fair definition.

CHAPTER IV.

ON THE SPECTROSCOPIC AND PHOTOGRAPHIC EVIDENCE OF A FRINGE ALONG THE MOON'S LIMB.

Spectroscopic.

YOUNG in 1869, and STONE in 1874, both examined the solar spectrum in the neighbourhood of the moon's limb, but neither of them were able to detect any additional lines, or change in the appearance of the ordinary Fraunhofer lines where they were cut off by the moon's limb.

Prof. C. A. Young,

BURLINGTON, IOWA,

9th Aug., 1869.

"The American Journal of Science and Arts" for November 1869, Vol. xlviii., No. 144, pp. 374-5.

Instrument.—A 4-inch telescope, with eyepiece, giving an image of the sun $2\frac{1}{8}$ inches in diameter, and spectroscope with slit $\frac{1}{8}$ th of an inch long, and five prisms of 45° .

While the moon was advancing upon the sun, special attention was paid to the appearance of the spectrum lines near her limb. They came up to the edge perfectly square and straight, even when the limb made an angle of only 5° or 6° with the slit; and the longitudinal line of demarcation between the two portions of the spectrum was hard and sharp, in striking contrast with the effect of the sun's limb, which, under similar circumstances, always gives a boundary more or less hazy and indefinite, and this to a degree continually changing from minute to minute. This contrast was beautifully exhibited a few seconds before totality, when the limbs of both sun and moon were on the spectrum together, the width of the visible portion of the sun having become less than the length of the slit. It was at first thought that this appearance was decisive against the

existence of a lunar atmosphere, however rare ; but a little consideration shows that, on the other hand, it is, if anything, favourable ; being a simple consequence of that brightening of the sun's disc near the moon's limb, which is so beautifully evident upon the photographs ; and which is most easily accounted for by admitting a slight refraction suffered by that portion of the sunlight which grazes the moon. Possibly, however, it may yet be explained as a case of simple inflection of light.

Mr. Stone,

KLIPFONTEIN,

16th April, 1874.

"Memoirs of the Royal Astronomical Society," Vol. xlii., p. 43.

With respect to the existence of additional absorption lines in the sun's spectrum near the moon's limb, I examined this point with considerable care during the partial phase, but I could not detect the presence of any additional lines, nor any sensible change in the appearance of any of the Fraunhofer lines in the spectrum near the moon's limb from that presented at considerable distances from it.

Photographic.

Reference has frequently been made to a band of increased brightness along the moon's limb in the partial-phase photographs. Professor Stephen ALEXANDER, in his account of the observations of the eclipse of 1860, published in the "Reports of the United States Coast Survey," (Appendix 21 to Report for 1860, p. 13), says that the bright band which he had observed through the telescope "is unquestionably pictured in the copies of daguerreotypes of the eclipsed sun, taken at Mr. Campbell's observatory in New York, under the supervision of Mr. Campbell and Professor Loomis, in May, 1854.

Mr. DE LA RUE, in his Bakerian Lecture on the eclipse of 1860,* says: "Photographs of the various phases of the partial eclipse, either previous to or after totality, exhibit a very curious phenomenon. The concave edge of the sun in immediate contiguity with the moon's limb, appears brighter than the other neighbouring parts of the crescent, while

* Published in the "Philosophical Transactions" for 1862, part i., p. 36.

the convex limb of the sun bordered by the dark background of the sky does not appear at all brighter than its proximate parts. This brightening of that part of the sun's disc which borders on the moon's limb extends only for the space of a narrow line beyond the latter, but is remarkably conspicuous." The Astronomer Royal, to whom Mr. De la Rue had pointed out the fact, ascribed it to an effect of contrast. And Mr. De la Rue, after describing certain experiments which he had made, expressed himself as of the same opinion.

Professor CHALLIS, in a paper entitled "On the Indications by Phenomena of Atmospheres to the Sun, Moon, and Planets," published in the "Monthly Notices," vol. xxiii., pp. 231-8, adduces the existence of the bright band upon the photographs in proof of a lunar atmosphere of extreme rarity.

The ASTRONOMER ROYAL, in a paper in the "Monthly Notices," vol. xxiv., pp. 13-19, "on the origin of the apparent luminous band which, in partial eclipses of the sun, has been seen to surround the visible portion of the moon's limb," shows by a theoretical investigation of the optical conditions, that refraction by a lunar atmosphere cannot cause apparent increase in brightness of the parts of the sun's disc adjacent to the place of the moon's limb. At page 188 of the same volume of the "Monthly Notices," the Astronomer Royal describes certain experiments which he had made, with specimens of partial-eclipse photographs which had been sent to him by Professor Stephen Alexander; and concludes that the phenomenon is due to nervous irritation of the retina, produced by the view of the conterminous black and white portions of the photograph.*

Professor MORTON, in the "Journal of the Franklin Institute," Sept. 1869, p. 209, says that the partial-phase photographs taken at Mount Pleasant in August, 1869, "all show an increase of light on the solar surface where it is in contact with the edge of the moon." He thinks that this is clearly not a subjective effect, but is due "to an increased deposit of silver" in the neighbourhood of the line of division between the light and dark parts of the picture.

* See also "Monthly Notices," vol. xxiv., p. 49; vol. xxv., p. 18; and paper by Professor Pickering in the "Journal of the Franklin Institute," April 1870, vol. lix., p. 264; "Comptes Rendus," vol. lxix., pp. 1234-6; "Journal of the Franklin Institute" for Dec. 1869, p. 374; "Philosophical Transactions," 1862, p. 368.

Dr. CURTIS also noticed a similar band of increased brightness along the moon's limb in the partial-phase photographs taken at Des Moines in 1869, and after repeating experiments similar to those described by Mr. De la Rue, he came to the conclusion that the appearance was not due to a sense of contrast. He therefore commenced experiments upon photographs of an artificial eclipse which he describes in the "Washington Observations" for 1870, Appendix II., p. 137.

He first photographed a circular disc of ground-glass, brightly illuminated from the back, with a piece of black paper pasted on it to represent the moon; but the negative did not show "the slightest trace of a bright border to the line of the dark disc." He then placed the artificial moon some inches in front of the illuminated disc, brought the limb of the artificial moon into sharp focus, and obtained a negative with a very marked bright border along the edge of the dark moon. To make sure that the appearance was not due to contrast, he placed beneath one of the negatives thus taken a piece of paper, on which was a line of printed dots. On holding the negative to the light, the dots could be plainly seen through the centre of the image of the ground-glass representing the sun; but close to the edge of the artificial moon they disappeared, nor could any amount of straining of the eyes make them visible; showing that for a narrow space bordering this edge the deposit in the negative was actually denser than on the rest of the image of the sun.

CHAPTER V.

PART OF MOON'S LIMB SEEN OUTSIDE THE SUN'S DISC.

THE evidence is somewhat conflicting as to whether any portion of the moon's limb can be traced beyond the sun's disc, except during the few minutes immediately before the commencement and after the end of totality; when, as will be seen from a future chapter, there is little doubt that the moon's limb can be seen projected on the corona.

In 1851, DUNKIN, GOOD, DAWES, HUMPHREY, OLUFSEN, GOUJON, SCHMIDT; in 1860, DAWES, BRUHNS, HAASE; and in 1868, CHISHOLM and TEBBUT looked for the moon's limb, but were not able to detect it. DAWES, GOUJON, SCHMIDT, HAASE, and CHISHOLM, describe how they moved the field of their telescopes so that the bright crescent of the sun was excluded, and how they made use of diaphragms and lighter sunshades, but were still unable to detect any trace of it.

HOUGH and GILMAN, in 1869, both concur in asserting that the moon's limb could not be seen before the first contact.

On the other hand, WILLOUGHBY, POPE, HOOK, and PHILIPS, in 1766; DEMBOWSKI in 1851, SIMMS in 1858, NOBLE in 1867, GILMAN in 1869, and WATSON in 1870, agree that they could trace the moon's limb for a few minutes beyond the sun's disc; and DOLLOND in 1826, HARDY in 1861, and WEISS in 1867, describe themselves as having traced it for a considerable distance, *weit hinaus*; while DE BIRTO and D'ARANJO, in 1858, speak of the moon as appearing perfectly round; and LIAIS actually says that three of the photographic plates taken during the partial phase of the same eclipse all show the outer limb of the moon with more or less distinctness.

SECCHI describes the lunar limb as being only occasionally visible; and DE BIRTO and D'ARANJO, in 1858, speak of the appearance of the moon as being alternately positive and negative.

It has been suggested that, although the corona in general may not be

sufficiently bright to form a background on which the moon's limb can be distinguished, yet that as the moon in its passage across the sun passes over prominences, and even brighter parts of the corona, it may be rendered visible, and may again be lost. It should be noticed, however, that none of the observers, except HARDY, who mention that they have seen the limb outside the sun's disc, describe the precautions they took to avoid being biassed by the presence in the field of the contiguous portion of the moon's limb projected upon the photosphere.

Mr. Willughby.

Dr. Pope.

Mr. Hook.

Mr. Philips.

LONDON,

22nd June, 1866.

"Philosophical Transactions," Hutton and Shaw's abridgment, Vol. i., p. III.

The greatest obscurity of the eclipse was somewhat more than seven digits. About the middle, between the perpendicular and westward horizontal radius of the sun, viewing it through Mr. Boyle's 60-foot telescope, there was perceived a little of the limb of the moon without the disc of the sun; which seemed to some of the observers to come from some shining atmosphere* about the body either of the sun or moon.

Mr. G. Dollond.

(No place given.)

29th Nov., 1826.

"Monthly Notices of the Royal Astronomical Society," Vol. i., pp. 26-7.

The morning was cloudy, but soon after the commencement of the eclipse there was a partial opening in the clouds, through which Mr. Dollond saw *a considerable part of the limb of the moon which had not yet entered on the disc of the sun.* Continuing his observations, after a short

* See also the account of the observations of Dembowski in 1851, and Weiss in 1867. The same shining atmosphere is evidently alluded to by Dembowski as "*una porzione di fascia di un colore per lo meno più chiaro del disco-lunare;*" and by Weiss as "*einem schwachen gelben Lichtschein*" around the sun's limb.

time as the clouds passed on, he again saw both the sun and a portion of the moon's border *which was off the sun's disc*. The sky then became cloudless, and he could no longer discern any part of the moon's limb, except that which eclipsed the sun.

Mr. Dunkin.

CHRISTIANIA,
28th July, 1851.

"Memoirs of the R. A. S.," Vol. xxi., part i., p. 12.

As the totality approached, I examined the moon's limb; but could not see it beyond the sun's limb.

Mr. J. W. Good.

KROPP,
28th July, 1851.

"Astr. Nachr.," Vol. xxxiii., p. 150.

I did not see the moon's circumference outside the sun's disc during the partial eclipse, either during the increase or decrease.

Rev. W. R. Dawes.

RÖEVELSBERG, near ENGELHOLM,
28th July, 1851.

"Memoirs of the R. A. S.," Vol. xxi., part i., p. 87.

No illumination of the moon's limb was ever perceived. At one time I thought there was some appearance of its outline just off the northern portion of the sun's disc, but on altering the position of the objects in the field, the appearance also varied; proving that it arose from some reflexion of the sun's light from one of the eye-glasses. The sun was at that time in the field; but when it was excluded no such appearance presented itself.

Mr. Humphreys.

CHRISTIANSTADT,
28th July, 1851.

"Memoirs of the R. A. S.," Vol. xvi., part i., p. 18.

No portion of the moon external to the sun's limb could be seen before the totality.

Baron Dembowski

CREMANO, near NAPLES,
28th July, 1851.

"Astr. Nachr.," Vol. xxxiii, p. 201.

Circa 20 m. prima della massima oscurazione, vide che il lembo orientale della luna per la lunghezza di 5° in 6° a partire dal como luminoso (ossia dal punto d' incontro delle circonferenze di due dischi) era circondato da una porzione di fascia di un colore per lo meno più chiaro del disco lunare, e del campo oscuro del telescopio della larghezza di circa $3'$, più larga e distinta, cominciando dal corno luminosa e sfumantesi a poco a poco, sembrandogli che fosse concentrica al disco del sole . . . Il disco solare era apparentemente affatto privo di una simile fascia. Su questa porzione di fascia od aureola gli parve di bene discernere il contorno del nostro satellite. Tale fenomeno si riprodusse al lembo opposto e nello stesso intervallo di tempo, colla differenza che secondo che la porzione d' aureola occidentale guadagnava in intensità quella orientale diminuiva, finchè circa 20 m. dopo la massima oscurazione, il tutto era svanito. La vista di questa porzione di aureola gli parve non fosse una semplice illusione, massime nel mezzo dell' eclisse in cui esisteva da ambe le parti del disco lunare.

Professor Olufsen.

CALMAR,
28th July, 1851.

"Astr. Nachr.," Vol. xxxiii., p. 219.

Ebenso wenig habe ich den Rand des Mondes ausserhalb der Sonne gewahr werden können.

M. Goujon.

DANTZIG,
28th July, 1851.

"Comptes Rendus," Vol. xxxiii., p. 180.

Avant le commencement de l'éclipse totale, j'ai cherché en vain à apercevoir la partie du limbe de la lune qui ne se projetait pas sur le soleil, même en ayant soin de mettre ce dernier astre en dehors du champ de la lunette. A 4h. 35m. 9s., ou 33 secondes environ après la fin de l'éclipse totale, j'ai vu très nettement le contour entier de la lune, il était surtout visible près de la périphérie du soleil. Je ne le distinguai plus au bout de quelques secondes; mais, sur l'invitation de M. Mauvais, ayant ôté le verre noir faible dont je me servais alors, je l'ai encore aperçu. Tout a disparu à 4h. 36m. 6s.

Dr. Julius Schmidt.

RASTENBURG,

28th July, 1851

"Beobachtung der Totalen Sonnenfinsterniss zu Rastenburg:" Bonn, 1852.

(p. 4.) Vor dem Anfange der Totalitat habe ich nie eine Spur des Mondrandes ausserhalb der Sonne erkennen konnen, obgleich ich sehr darauf Acht gab, selbst dann nicht, wenn ich die Sonne aus dem Gesichtsfelde entfernte, und in dieser Lage das dunkle Augenglas zuruckzog.

Moon's limb carefully looked for, but not seen

Mr. W. Simms, Jun.

138, FLEET STREET, LONDON,

15th March, 1858.

"Monthly Notices," Vol. xviii., p. 189.

When the eclipse had pretty far advanced, probably about a fifth of the sun's diameter being covered, a thin cloud or haze spread itself over the sky, and an exceedingly light neutral tint shade was sufficient. I then distinctly saw the moon's edge for a distance of about five minutes beyond the sun's limb, the moon's surface being also of a different shade from the sky beyond, reminding me of the colour of the dark surface at the time of the young moon.

M. de Birto.

L'ILE DE PINHEIROS

M. d'Aranjo.

7th Sept., 1858.

"Astr. Nachr.," Vol. xlix., p. 280.

MM. de Birto et d'Aranjo ont faite une observation curieuse, et qui indiquerait que la vision de la lune aurait été alternativement positive et négative. A partir du 1^{er} contact, disent-ils, la lune continuant toujours sa marche vers l'orient, se montra parfaitement ronde et obscure jusqu'à 10 h. 5 m. 10 s. instant où elle s'approchait des taches obscures qu'on apercevait dans le soleil. Nous avons remarqué que le limbe inverse était plus clair et qu'après que les taches se furent recouvertes, la couleur obscure du reste de l'astre est revenue.

Moon alternately brighter and darker than the surrounding sky (Query)

M. de Mello.

PARANAGUA,

M. Liais.

7th Sept., 1858.

"Astr. Nachr.," Vol. xlix., p. 279.

Avec une lunette de quatre pouces d'ouverture, M. de Mello l'a aperçue [*i.e.* the moon] se prolongeant hors des cornes solaires dans l'espace de 4 à 5 minutes.

Moon's limb traced outside the sun's disc, but later on it could not be seen. Image of dark moon seen projected on ground glass

M. Liais, qui avait quatre lunettes sur la même monture, n'a pu voir ce prolongement dans une lunette de deux pouces grossissant soixante fois, ni dans sa lunette divisée, mais dans la plus petite de ces lunettes qui grossissait trente fois, il a pu suivre la contour de la lune hors des cornes du soleil jusqu'à une distance de 7" à 8", surtout près de la corne inférieure en apparence. Avec sa lunette de trois pouces et le grossissement de 179 fois, il a vu le prolongement de la lune pendant une espace de 2' l'environ du côté de la corne inférieure en apparence. Ces observations ont eu lieu entre 10 h. 7 m. et 10 h. 12 m. Plus tard le même observateur a cherché de nouveau, mais sans succès, à revoir le limbe de la lune hors du contour du soleil.

A peu près vers l'instant où avaient lieu ces observations, l'image de la lune projetée sur une glace dépolie avec un objectif de trois pouces et de 2.184 m. de longueur focale, était vue en entier et très distinctement. Cette image projetée de la lune en dehors du contour solaire paraissait sur la glace dépolie plus blanche que la région voisine du ciel. Cette apparence a été vue encore à 10 h. 40 m., mais plus faible. Plus tard il n'a pas été possible de la revoir.

Un phénomène très singulier et tout à fait nouveau qui s'est produit est l'apparition de cette image sur les photographies* du soleil tirées à 10 h. 6 m. 56.4 s.; 10 h. 8 m. 17.9 s.; 10 h. 10 m. 59.6 s.; et 10 h. 11 m. 36.6 s.; surtout sur les deux premières.

Rev. W. R. Dawes

HADDENHAM, BUCKS,

18th July, 1860.

"Monthly Notices," Vol. xxi., p. 26.

The moon's limb, just off the disc of the sun and close to it, was repeatedly examined by placing portions of it in a small field of my solar eyepiece, from which the sun was excluded, and using as light a shade as my eye could comfortably bear. No light on any part of the moon's edge could be even suspected.

* For further particulars as to the visibility of the lunar limb in the photographs, see the memoir of Dr. Liais.

Prof. C. Bruhus.

TARAGONA,

18th July, 1860

“Berichte der Kon. Sachs. Gesellschaft der Wissenschaften Mathematisch—Physikalische Classe,” Sitzung am 12ten Dec., 1860, p. 221.

Man hat behauptet, dass bei totalen Finsternissen der ganze Mond bereits geraume Zeit vor Anfang der Totalität sichtbar werde, und dass er nicht immer ganz schwarz, sondern hin und wieder gefärbt erscheine. Um zu untersuchen, ob diese Wahrnehmungen sich bei der gegenwärtigen Finsterniss zeigen wurden, sah ich oft in das Dollond'sche Fernrohr und auch in den Cometensucher, habe aber bis kurz vor Anfang der Totalität (20 Secunden vorher) nur immer vom Monde soviel gesehen als sich vor der Sonnenscheibe befand und dieser Theil war stets kohlschwarz.

Part of moon outside sun only seen 20 sec before totality. Moon always black

Herr C. Haase.

VALENCIA,

18th July, 1860.

“Astr. Nachr.,” Vol. liv., p. 339.

Um 2 h. 30 m. [37 minutes before totality] nahm ich das Blendglas eine Zeitlang weg und entfernte den hellen Theil der Sonne aus dem Gesichtsfelde, um zu sehen, ob man etwas von dem Umriss des dunkeln Mondrandes ausserhalb des Sonnendiscus erblicken konnte; jedoch zeigte sich noch nichts dergleichen.

Moon's limb could not be seen outside sun half an hour before totality 10 min before totality and 10 min after totality it could be traced for a short distance.

Um 2 h. 59 m. sah ich (bei wieder vorgenommenem Blendglase) dass man am südlichen Rande des Mondes allerdings dessen Contour auf eine Distanz von etwas mehr als eine Quadratselte des Micrometers ausserhalb der Sonnenscheibe erkennen konnte. Der Mondrand war hier durch einen schmalen weissen Lichtsaum begreuzt, der in der Nähe des Sonnenrandes am intensivsten war, dessen Breite ich dort zu 30" schätzte, und der dann spitzig am Mondrande sich verlief. So viel Mühe ich mir auch gab, so konnte ich doch von der weiteren ausseren westlichen Peripherie des Mondes nichts sehen,

(p. 341.) Sehr interessant war es mir, zu bemerken, dass um 3 h. 20 m. der untere (also nördliche) schwarze Mondrand ausserhalb des Sonnendiscus sichtbar wurde, und zwar nur in derselben Ausdehnung, wie es vorhin der entgegengesetzte Rand gewesen war. Dasselbe schmale weisse Licht

begreuzte ihn. Jetzt bei der Rückbildung der Sonnenfinsternis, oberen (also südlichen) Theile dagegen nichts von dieser zu bemerken. Um 3 h. 35 m. war jedoch jede Spur die verschwunden.

Padre A. Secchi.

DESERTO DE LA

11

"Comptes Rendus," Vol. li., p. 157.

Could not be
seen at first. At
2 h. 19 m. visible
—later on lost.

Quelques minutes après le commencement, je chercha disque de la lune à l'extérieur du soleil, mais je ne pus y parvenir. 19 m. je réussis à le voir très-nettement dans une étendue d'en plus; mais quelque temps après la lune disparut, et depuis lors être observée que par instants. Cela serait-il dû à la diversité de la couronne solaire sur laquelle le disque de la lune se projet

Don Antonio Aguilar.

DESERTO DE LA

12

"Über Totale Sonnenfinsternisse," Dr. von Mädler, p. 26.

13 m after the
beginning,
moon's limb seen
for 20" outside
above, below
only half as far.

Dreizehn Minuten nach dem Anfange sah ich schon den ausserhalb der Sonnenscheibe, oben bis zu 20", unten nur et weit.

Mr. R. W. H. Hardy.

SION HILL,

31st

"Monthly Notices," Vol. xxii., p. 91.

When the moon reached the middle of the eclipse, . . . fully excluding every ray of direct solar light, the moon's traceable upwards to a considerable distance from both cu illuminated by a faint twilight.

Capt. W. Noble.

MARSHALL

6th M

"Monthly Notices," Vol. xxvii., p. 185.

About 22 h. 15 m. 15 s., L. M. T., I could trace the moon's one or two minutes of arc beyond the cusps of the sun; the between its jet blackness and the blue of the sky being very appa

Dr. Ed. Weiss.

RAGUSA,

6th March, 1867.

Vol. lv. of the "Sitzb. d. k. Akad. d. Wissensch.," ii. Abth., May 1867.

(p. 17.) Der Mondrand war weit über die Sonnenscheibe hinaus zu bemerken und von einem schwachen gelben Lichtschein umsäumt, der unmittelbar am Sonnenhorne am breitesten und unmittelbar längs des Mondesrandes am hellsten war, und sich von da weg allmählig im hellen Hintergrunde verlor.

The moon's limb was to be traced far outside the sun's disc, surrounded by a yellow light.

Mr. R. F. Chisholm.

MADRAS,

18th Aug., 1868.

"Report of the Government Astronomer upon the Observations of the 1868 Eclipse."

(p. 28.) I turned the crescent out of the field of view, and removed the dark glass, but could not get the faintest indication of the dark limb of the moon upon the sky.

Mr. J. Tebbutt.

WINDSOR, NEW SOUTH WALES,

18th Aug., 1868.

"Monthly Notices," Vol. xxix., p. 2.

A careful scrutiny satisfied me that not the slightest portion of the moon's limb could be even faintly distinguished beyond the cusps.

Prof. G. W. Hough.

MATTOON, ILLINOIS,

7th Aug., 1869.

"Journal of the Franklin Institute," Jan. 1870, p. 61.

As the time drew near for the first contact of the moon's limb, each observer examined carefully the region where the moon was expected, to see whether it would be visible before contact with the solar disc. The closest scrutiny of five observers failed to discover it.